

Claims

1. A method for controlling distortion of
a material during a weld process, including the steps
5 of:

modeling the weld process of the material;
determining distortions produced by the weld
process in the model;
determining a plurality of simulated induced
10 distortions in the model to offset the produced
distortions;
generating a plurality of actual induced
distortions in the material as a function of the
simulated induced distortions; and
15 performing the weld process on the material.

2. A method, as set forth in claim 1,
wherein determining a plurality of simulated induced
distortions includes the step of determining at least
20 one of a plurality of pre-straining and pre-cambering
distortions, and wherein generating a plurality of
actual induced distortions includes the step of
generating the at least one of the plurality of pre-
straining and pre-cambering distortions.

25 3. A method, as set forth in claim 2,
wherein generating a plurality of pre-straining
distortions includes the step of bending the material
into a permanent distorted shape.

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4. A method, as set forth in claim 2, wherein generating a plurality of pre-cambering distortions includes the step of bending the material into a temporary distorted shape.

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5. A method, as set forth in claim 4, wherein bending the material into a temporary distorted shape includes the step of clamping the material into a pre-cambering fixture adapted to hold the material in the temporary distorted shape.

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6. A method, as set forth in claim 5, further including the steps of:

modeling the locations of a plurality of clamps for clamping the material into the pre-cambering fixture in response to the step of determining a plurality of simulated pre-cambering distortions;

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modeling the steps of welding the material by at least one simulated robotic welding arm;

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modifying the pre-cambering fixture to prevent interference to the at least one simulated robotic welding arm from performing the desired welding;

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installing a plurality of actual clamps at the desired locations to clamp the material into the pre-cambering fixture; and

performing the welding process by at least one actual robotic welding arm.

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7. A method, as set forth in claim 6,
wherein modifying the pre-cambering fixture includes
the step of moving the location of at least one
simulated clamp.

5 8. A method for controlling distortion of
a material during a welding process, including the
steps of:

modeling the weld process of the material;
determining distortions produced by the weld
10 process in the model;
determining a plurality of simulated pre-
straining distortions in the model to offset the
produced distortions;
generating a plurality of actual pre-
15 straining distortions in the material as a function of
the simulated pre-straining distortions; and
performing the weld process on the material.

9. A method, as set forth in claim 8,
20 wherein generating a plurality of pre-straining
distortions includes the step of bending the material
into a permanent distorted shape.

10. A method for controlling distortion of
25 a material during a weld process, including the steps
of:

modeling the weld process of the material;
determining distortions produced by the weld
process in the model;
30 determining a plurality of simulated pre-

cambering distortions in the model to offset the
produced distortions;

generating a plurality of actual pre-
cambering distortions in the material as a function of
5 the simulated pre-cambering distortions; and
performing the weld process on the material.

11. A method, as set forth in claim 10,
wherein generating a plurality of pre-cambering
10 distortions includes the step of bending the material
into a temporary distorted shape.

12. A method, as set forth in claim 11,
wherein bending the material into a temporary
15 distorted shape includes the step of clamping the
material into a pre-cambering fixture adapted to hold
the material in the temporary distorted shape.

13. A method, as set forth in claim 12,
20 further including the steps of:

modeling the locations of a plurality of
clamps for clamping the material into the pre-
cambering fixture in response to the step of
determining a plurality of simulated pre-cambering
25 distortions;

modeling the steps of welding the material
by at least one simulated robotic welding arm;

moving the location of any simulated clamps
which prevent the at least one simulated robotic
30 welding arm from performing the desired welding;

installing a plurality of actual clamps at the desired locations to clamp the material into the pre-cambering fixture; and

performing the welding process by at least
5 one actual robotic welding arm.

14. A method for controlling distortion of a material during a weld process, including the steps of:

10 modeling the weld process of the material;
determining distortions produced by the weld process in the model;

determining a plurality of simulated pre-cambering distortions in the model to offset the
15 produced distortions;

modeling the locations of a plurality of clamps for clamping the material into a pre-cambering fixture;

modeling the steps of welding the material
20 by at least one simulated robotic welding arm;

moving the location of any simulated clamps which prevent the at least one simulated robotic welding arm from performing the desired welding;

installing a plurality of actual clamps at
25 the desired locations to clamp the material into the pre-cambering fixture and responsively generate a plurality of actual pre-cambering distortions in the material; and

performing the welding process by at least
30 one actual robotic welding arm.